

Sublattice melting in binary superionic colloidal crystals

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Here we have identified a superionic-like crystal structure in size-asymmetric charged colloidal systems where the smaller particles melt and hold the larger particles in a crystalline lattice via screened Coulomb interactions. By cooling down the system, the small mobile particles condense to interstitial positions, resulting in an ionic-like structure. This state of the system may provide insights for growing heterostructures. Overall, our findings provide guidelines to assemble metallic or superionic conductor colloidal crystals and set up the foundation for discovering exciting properties and functions of multicomponent colloidal crystals.

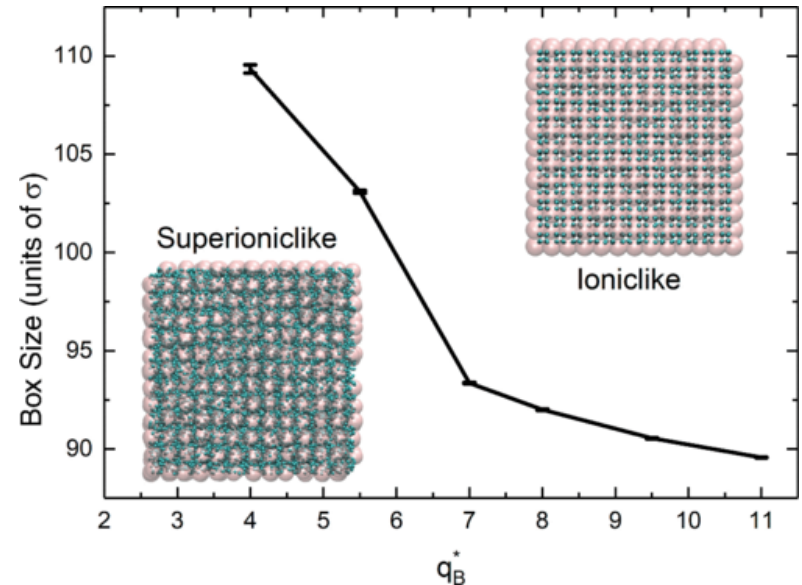


Figure: Simulation box size under different reduced charges of the small particles (q_B^*) at $T^*=0.3$, for $N_B/N_A=8$ and $q_A^*=-247$ at $\kappa\sigma=0.7$. Two distinct phases are observed, superionic-like and ionic-like; the snapshots are from the [001] direction of the fcc crystal.